MOTOROLA

ASTRO™ Digital Spectra® Mobile Radios

Dual Control Head Radio System

Service Manual

Foreword

The information contained in this manual relates to the ASTRO® Spectra® Dual Control Head Radio System. This manual provides sufficient information to enable service shop personnel to troubleshoot and repair an ASTRO Spectra Dual Control Head Radio System.

Safety Information

Before operating an ASTRO Spectra Radio System, please read the “Safety Information” section in the front of this manual.

Manual Revisions

Changes which occur after this manual is printed are described in “FMRs.” These FMRs provide complete information on changes, including pertinent parts list data.

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Related Publications

Spectra® Detailed Service Manual 68P80102W61
Spectra VHF VCO Section Detailed Service Manual Supplement 68P81074C48
Spectra High-Power Power Amplifier Detailed Service Manual Supplement 68P81077C25
Spectra Systems 9000 Control Unit Detailed Service Manual Supplement 68P81077C30
Spectra A5 and A7 Control Head Instruction Manual 68P81109C33
Spectra A4 Control Head Detailed Instruction Manual 68P81109C34
ASTRO™ Digital Spectra Hand-Held Control Head (Model W3) User's Guide 68P81073C25
ASTRO Digital Spectra (Models W4, W5, W7, and W9) User's Guide 68P81074C80
ASTRO Digital Spectra Mobile Radios Basic Service Manual 68P81076C20
ASTRO Digital Spectra Mobile Radios Detailed Service Manual. 68P81076C25

Safety Information

Safe And Efficient Operation of Motorola Two-Way Radios

Exposure To Radio Frequency Energy

National and International Standards and Guidelines

Your Motorola Two-Way Radio, which generates and radiates radio frequency (RF) electromagnetic energy (EME), is designed to comply with the following National and International Standards and Guidelines regarding exposure of human beings to radio frequency electromagnetic energy:

- Federal Communications Commission Report and Order No. FCC 96-326 (August 1996)
- American National Standards Institute (C95.1 - 1992)
- National Council on Radiation Protection and Measurements (NCRP - 1986)
- International Commission on Non-Ionizing Radiation Protection (ICNRP - 1986)
- European Committee for Electrotechnical Standardisation (CENELEC):
    - ENV. 50166-1 1995 E — Human Exposure to Electromagnetic Fields Low Frequency (0Hz to 10kHz)
    - ENV. 50166-2 1995 E — Human Exposure to Electromagnetic Fields High Frequency (10kHz to 300GHz)
    - Proceedings of SC211/8 1996 — Safety Considerations for Human Exposure to E.M.F.s from Mobile Telecommunications Equipment (M.T.E.) in the Frequency Range 30MHz - 6 GHz (E.M.F. - Electromagnetic Fields)

Radio Operation and EME Exposure

To assure optimal radio performance and that human exposure to radio frequency (RF) electromagnetic energy is within the guidelines set forth in the above standards, transmit with any radio *only* when people inside and outside the vehicle are no closer than the distance shown in Table 1.

Table 1 Rated Power and Distance

Rated Power of Vehicle-installed Two-way Radio	Minimum Distance from Transmitting Antenna
7 to 15 Watts	1 Foot (30.5 Centimeters)
16 to 50 Watts	2 Feet (61.0 Centimeters)

Electromagnetic Interference/Compatibility

Note: Nearly every electronic device is susceptible to electromagnetic interference (EMI) if inadequately shielded, designed, or otherwise configured for electromagnetic compatibility.

Operational Warnings

WARNING

- Vehicles With an Air Bag

  Do not place a portable radio or install radio communications equipment in the area over an air bag or in the air bag deployment area. Air bags inflate with great force. If a portable radio is placed in the air bag deployment area and the air bag inflates, the radio may be propelled with great force and cause serious injury to occupants of the vehicle.

  - Installation of vehicle communication equipment should be performed by a professional installer/technician qualified in the requirements for such installations. An airbag's size, shape, and deployment area can vary by vehicle make, model, and front compartment configuration (e.g., bench seat vs. bucket seats).
  - Contact the vehicle manufacturer's corporate headquarters, if necessary, for specific airbag information for the vehicle make, model, and front compartment configuration involved in your communication equipment installation.

- Potentially Explosive Atmospheres

  Turn your radio *OFF* in any area with a potentially explosive atmosphere. It is rare, but your radio or its accessories could generate sparks. Sparks in such areas could cause an explosion or fire, resulting in bodily injury or even death.

  Note: The areas with potentially explosive atmospheres referred to above include fueling areas such as: below decks on boats; fuel or chemical transfer or storage facilities; areas where the air contains chemicals or particles, such as grain, dust, or metal powders; and any other area where you would normally be advised to turn off a vehicle engine. Areas with potentially explosive atmospheres are often, but not always, posted.

  DO NOT transport or store flammable gas, liquid, or explosives in the compartment of your vehicle that contains your radio or accessories.

  Vehicles powered by liquefied petroleum gas (such as propane or butane) must comply with the National Fire Protection standard (NFPA-58). For a copy of this standard, contact the National Fire Protection Association, One Batterymarch Park, Quincy, MA, Attn: Publications Sales Division.

- Blasting Caps and Blasting Areas

  To avoid possible interference with blasting operations, turn your radio off when you are near electrical blasting caps, in a blasting area, or in areas posted "Turn off two-way radio." Obey all signs and instructions.

Operational Cautions

Caution

- Antenna Information

  Antennas should be installed according to installation instructions supplied with the equipment. To ensure compliance with the standards listed above, use only recommended antenna types, such as a 1/4-wave vertical whip or vertical gain antenna.

- Electronic Devices

  Most modern electronic equipment—for example, equipment in ambulances, navigation equipment, etc.—is shielded from RF energy; however, RF energy from your radio may affect some electronic equipment.

  Consult your physician or the manufacturer of any personal medical devices (such as pacemakers, hearing aids, etc.) to determine if they are adequately shielded from external RF energy. The operation of inadequately shielded medical devices may be adversely affected when operated near a radio.

  Turn the radio *OFF* in health-care facilities when any regulations posted in the areas instruct you to do so. Always request permission before using the radio near medical equipment.

  RF energy may affect electronics systems in some motor vehicles. Check with your vehicle manufacturer's representative to be sure that the radio will not affect your vehicle's electronic system.

Efficient System Operation

- *DO NOT* operate your radio unless all RF connectors are properly terminated.
- All equipment must be properly grounded according to Motorola installation instructions for safe operation.
- All equipment should be serviced only by an authorized technician.

Option Table

Kit	Description	W800 Option Suffix								
		BS	BT	BU	BV	BW	BX	BZ	CA	CF
HCN1121_	W9 Control Head Rear	1				1		1	1	
HCN4071_	W4 Control Head Rear		1							1
HLN4921_	Trunion/Hardware	1				1		1	1	
HLN6105_	Spare Button Kit	1	1	1	1	1	1	1	1	1
HLN6249_	Button W4 Secure									1
HLN6432_	Back Housing Kit		1	1	1		1			1
HLN6476_	System 9000 Button Kit A9 Clear							1		
HLN6481_	System 9000 Button Kit E9 Clear								1	
HLN6523_	Button W7				1					
HLN6524_	Button W7						1			
HLN6548_	Button W5			1						
HLN6549_	Button W4		1	1						
HLN6675_	System 9000 Button Kit E9 Clear	1								
HLN6800_	System 9000 Button Kit Secure W9					1				
HLN6813_	ASTRO Spectra DCH Trunion Kit		1	1	1		1			1
HLN6814_	ASTRO Spectra W5/7 PCB Rear			1	1		1			
HLN6815_	Hardware Control W5 Rear			1						
HLN6816_	Hardware Ctrl W7 Rear				1		1			

Notations Used in This Manual

Throughout the text in this publication, you may notice the use of warnings, cautions, and notes. These notations are used to emphasize that safety hazards exist, and care must be taken and observed.

NOTE: An operational procedure, practice, or condition, etc., which is essential to emphasize.

Caution

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in equipment damage.

WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or injury.

DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or injury.

You will also find in this publication the use of the asterisk symbol (*) to indicate a negative or NOT logic true signal.

Notes

Description and Operation

1

The Dual Control Head configuration for ASTRO™ Spectra® radio systems allows one radio to operate using either of two control heads. One control head commands the radio system at a time. Command can be transferred from one control head to the other at any time during system operation.

General

The Dual Control Head configuration adds a second control head as a rear control head. One head is installed as the front control head and the second is installed as the rear control head.

The front control head switches radio system power on or off and enables or disables any other options within the system. When the radio system first turns on, the front control head commands the system. The front control head's power on/off switch is always enabled.

Command is transferred between control heads by pressing the F/R button on the control head. When command changes, the rear control head takes command and the front control head goes into the remote state. When the front unit is in the remote state, its display shows "REMOTE." Only three buttons function when the control head is in the remote state: F/R, DIM, and Emergency. The DIM button changes the display's brightness. All other buttons, including the PTT button, are disabled.

NOTE: If a siren unit is also installed, siren control buttons are also enabled at all times.

The XMIT and BUSY indicators on the remote control head indicate the activities of the control head currently in command. When command transfers between control heads, the speaker audio and volume control also transfer to the commanding control head. Individual front and rear volume levels are maintained at each control head.

Changing Command

Press F/R to change command from either control head to the other. To resume command from the remote condition, check the XMIT indicator for activity before transferring command. This step is for courtesy only. No radio damage occurs if command transfers during a transmission, but the transmission is interrupted.

Check the state of the control head (command or remote) before pressing the PTT button. If the PTT button of the remote control head is pressed when the command control head is transmitting, a drop in transmit deviation and a mixing of microphone audio may occur.

All option status selections, scan lists, and RX/TX mode selections made at one control head automatically transfer to the other control unit when command transfers. Programming for button configuration of the two control heads is done simultaneously in the RSS, and so both must be identical.

Installation

2

Standard Installation (Without Siren)

The front control head uses a standard 17-foot radio control cable. The rear control head cable connects to the secondary connector on the ASTRO Spectra radio. This cable is orderable in a 17-, 30-, 40-, 50-, or 75-foot length; see Table 2 for a list of available cable kits. The primary connector is labeled “control unit.” Only the front cable has the green receiver power wire and orange transmitter wire.

Table 2 Rear Control Head Cables

Kit No.	Description
HKN4378_	Rear control head cable, 17-foot
YKN4242_	Rear control head cable, 30-foot
YKN4243_	Rear control head cable, 40-foot
YKN4244_	Rear control head cable, 50-foot
YKN4245_	Rear control head cable, 75-foot
HKN4376_	Rear control head T-cable (for use with siren), 22-foot
YKN4206_	Rear control head T-cable (for use with siren), 50-foot

W4, W5, or W7 Rear Control Heads (Figures 1 and 2) are labeled “Rear Control Head” on their bottom surface. W9 Rear Control Heads are labeled “HCN1121_ Rear” on the back nameplate.

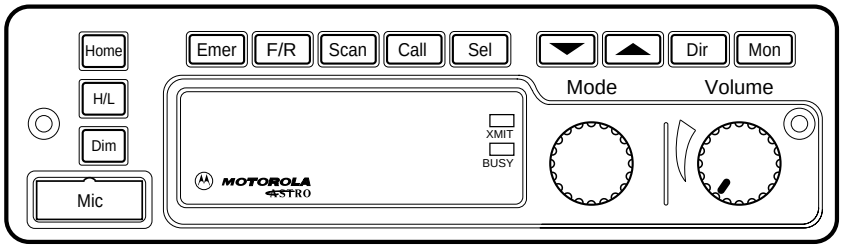


Figure 1 W4 Control Head (Typical)

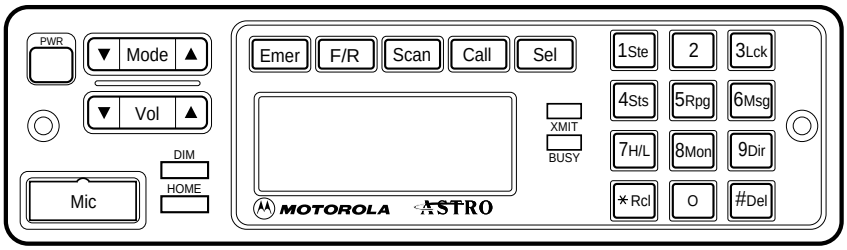


Figure 2 W7 Control Head (Typical)

Install both control heads as described in the ASTRO Spectra Instruction Manual Supplement (68P81070C85). Connect the green and orange wires as described for the front control head. Install one speaker audio switching pod behind each control head by plugging the pod into the VIP socket, radio speaker pigtail and speaker lead (see Figure 3). Tuck the pod under the radio cable and microphone cable connectors. Be sure to attach the speaker wire S-hook to the strain relief bracket on the back of the control head.

Caution

When installing the front/rear control head option, be certain to install the speaker audio switching pods. Otherwise, the increased load may cause a power amplifier failure.

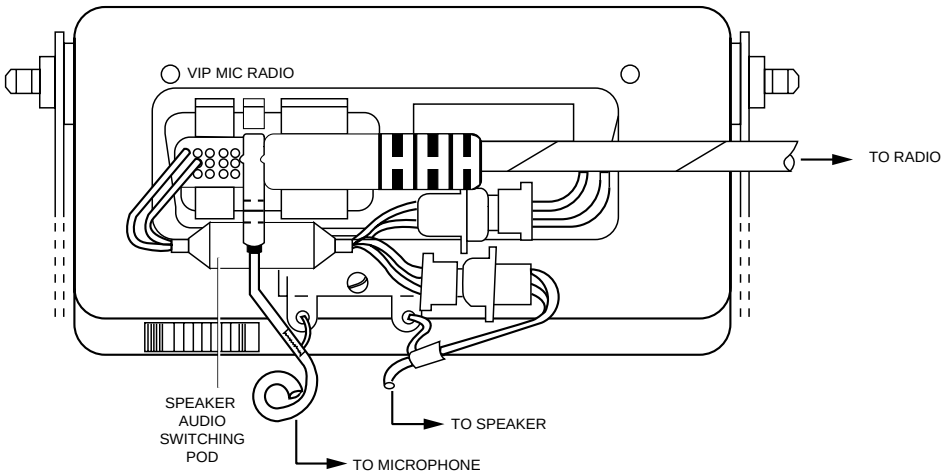


Figure 3 Control Head With Switch Pod

Siren/Public Address Installation

The Siren/Public Address option installs with a Direct Entry Keyboard (DEK) housing (see Figure 4). When installing the Dual Control Head configuration with the Siren/PA option, first connect the siren-to-control head T-cable to the siren, followed by the siren-to-radio cable Available T-cables are shown in Table 2.

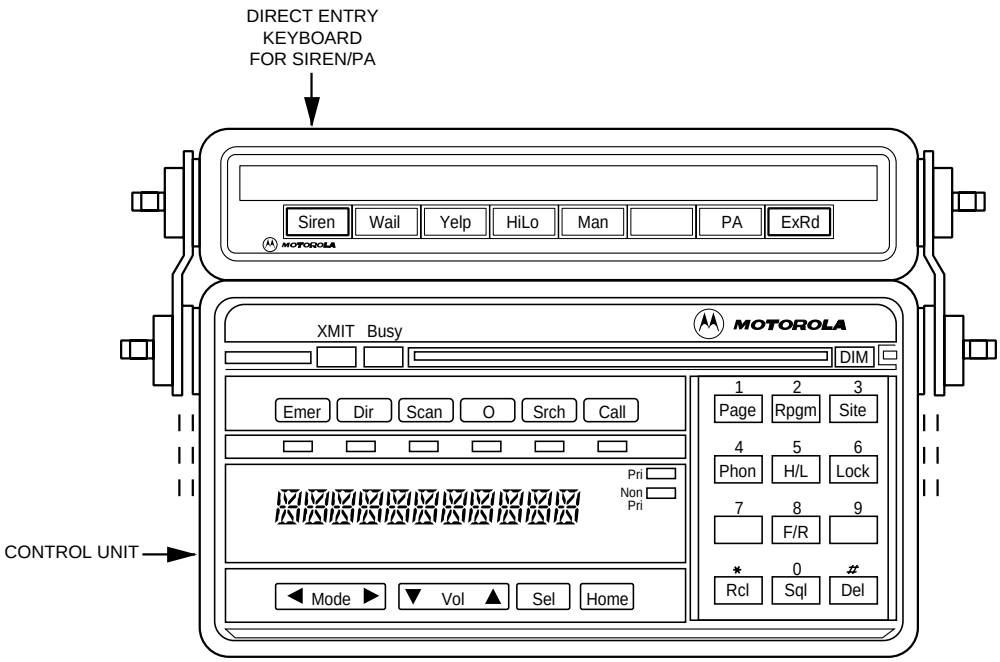


Figure 4 W9 Control Head With Siren/PA

Replace the short retaining knob on the siren cable with the longer knob. Install one speaker audio switching pod behind each control head by plugging it into the VIP socket for the DEK option housing.

Note that the audio switching pod VIP connector is different for a DEK option. Splice the switching pod into the speaker pigtail and speaker lead as shown in Figure 5. If there are more than one option housing, factory programming defaults to the DEK housing nearest the control head with the correct VIP presets to drive the relay switching pod.

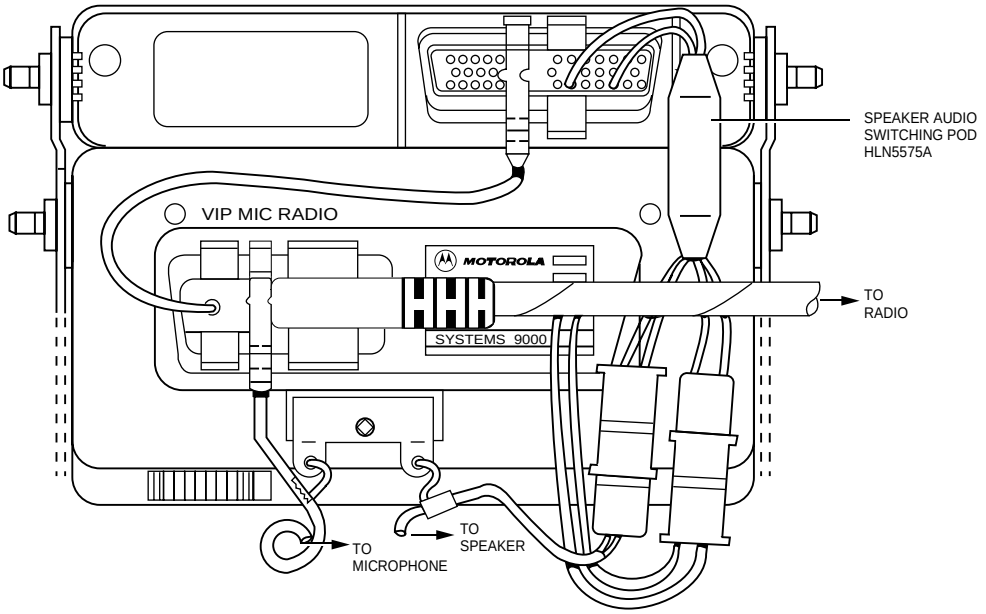


Figure 5 Switching Pod for Options With DEK

Retrofit Kits

Retrofit kit options enable the conversion of a remote-mount mobile to work in a dual control head configuration. The following retrofit kits are available:

Table 3 Retrofit Kits

Description	Option No.
W4 (Rotary Knob) Dual Control Head	H1762_
W5 (8-Button Keypad) Dual Control Head	H1763_
W7 (12-Button Keypad) Dual Control Head	H1764_
W9 (System 9000) Dual Control Head	H1761_

Retrofit kits enable the conversion of a remote-mount mobile to work in a dual control head configuration. The minimum requirements for an existing radio to accept a retrofit kit are:

- The existing radio must have firmware version R09.60.02, or later,
- The existing radio must use RSS version R07.5, or later,
- The existing radio must have a 1 Meg Vocon Board – HLN6458_. 1 Meg capability can be confirmed either by the 1 Meg designator on the model/serial number label, or by putting the unit into test mode. In test mode 1Meg will be displayed during initial test access.

Follow normal installation steps to install the rear control head, adding an audio relay pod to the existing control head and changing the front control head phone button to F/R (kit HLN6834_). Using the RSS, follow the system programming steps in section 3 of this manual to configure the radio for dual control head operation.

System Programming

3

EEPROM Programming

Specific programming instructions are supplied in the ASTRO Spectra Radio Service Software (RSS) manual. However, there are several important things to remember when programming a Dual Control Head system. These include:

- The “Dual Control Head” field on the **Radio-wide More Options** screen must be set to Enabled.
- If DEKs on both front and rear control heads is desired, the corresponding RSS field must be set to reflect that.
- To allow proper speaker muting, program “VIP Output 2” on the **Change/View: Control Head: VIP Out** screen to be “Front/Rear Control.” This allows the speaker audio switching pod to function correctly.

The Siren/PA option buttons are in a DEK housing and are programmed to always be active. This housing uses one of the VIP ports on a control head, so program the speaker audio switching relay pod on the first DEK that was added. The housing is normally installed on the control head used by the vehicle’s driver.

The VIP outputs of both control heads are always active. VIP inputs are only active at the front control head. All buttons are programmed the same for front and rear control heads. An emergency footswitch may be connected to both front and rear control heads; however, a switch that failed to open after activation of both switches would not be detected. The recommended installation is to wire all emergency switches in series to one control head.

An **ERROR 05/10** or **ERROR 06/10** message will be displayed if either the front or rear control head is missing or not connected properly.

Notes

Theory of Operation

4

The following discussion of the Dual Control Head option consists of two sections: Software Changes and Hardware Changes.

Software Changes

A single control head at the front position can operate the radio system alone if necessary. When the rear control head is out of the Dual Control Head system, “ERROR 06/10” is displayed after the system is powered on.

Although one control head is always in a remote state, both units monitor the serial bus and process messages. When command transfers, serial bus commands are exchanged between both the radio and the rear control head. The radio momentarily mutes speaker audio and each control head instructs the other to change the state of its speaker audio switching pod.

Hardware Changes

The unique hardware changes include the rear control head control cable. This cable is a 17’ version of the standard control cable for systems without a siren, or a 22’ T-cable version for systems with a siren. The siren itself plugs into the spare front radio connector. The front control head cable has green and orange power leads.

The two speaker audio switching pods route audio to the correct location, front or rear. When command transfers, each pod opens the circuit at one control head and closes the circuit at the other. This maintains a constant speaker load on the radio and allows the system to have two independent volume levels. Speaker audio always mutes when the relays switch so speaker switching noise does not sound in the speaker.

The relay pod is a polarized miniature relay, wired in a normally closed configuration. If the relay coil wires are reversed or plugged into the wrong or a bad VIP port, the relay remains closed and does not open when command transfers. If the rear control head is removed from the system, the remaining relay stays closed and the speaker functions normally.

Notes

Troubleshooting and Repair

5

Error Code Displays

Use Table 4 to help you troubleshoot error messages that continue to be displayed after you have programmed the radio. Table 4 gives the possible causes of different error codes that display on one or both control heads and indicates which control head has a fault. See the appropriate standard instruction manual for troubleshooting charts for codes not covered.

Table 4 Front/Rear Control Head Error Codes

Front Display	Rear Display	Description of Error
ERROR 06/10	——	Rear control head not connected. Radio can operate.
——	ERROR 05/10	Front control head not connected.
FAIL 05/82	FAIL 05/82	Front EEPROM bad checksum.
FAIL 05/82 and ERROR 06/10	FAIL 05/82 and ERROR 06/10	Rear EEPROM bad checksum. Remove rear control head to operate radio system.
FAIL 01/90	FAIL 05/90	Front control head bus failure
ERROR 06/10	FAIL 01/90	Rear control head bus failure

W4 Dual Control Head

The W4 Rear Control Head is the standard W4 Control Head with a new volume control and addressing jumpers. Use the Spectra A4 Control Head Instruction Manual, 68P81109C34, for a guide to the layout.

The specific differences for the HCN4071_ Rear Control Head are:

- Front Panel Plastic — 1502117Z09.
- The Volume Control (without off/on switch) and Mode Switch Assembly, 0105956T34, is for the rear control head only.
- Address/Power jumpers:
  - JU1 Placed
  - JU19 Placed
  - JU20 Placed

W5 and W7 Dual Control Heads

Use the Spectra A5 and A7 Control Head Instruction Manual, 68P81109C33, for a guide to the layout.

With the placement of jumpers JU1 and JU7, the highlighted parts become inactive and are, therefore, not placed. The differences between HLN6814_ and HLN6396_ are as follows:

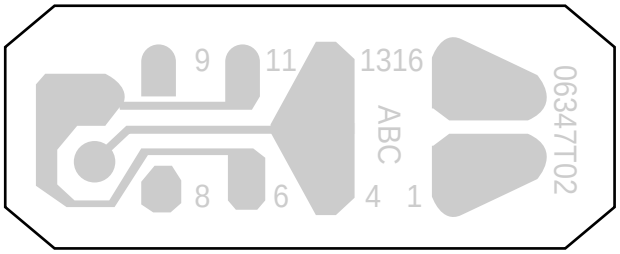
Reference Desig.	HLN6814_	HLN6396_
JU1	Placed	Not Placed
JU7	Placed	Not Placed
JU19	Placed	Not Placed
JU2	Not Placed	Placed
C3	Not Placed	Placed
C4	Not Placed	Placed
C5	Not Placed	Placed
C43	Not Placed	Placed
C48	Not Placed	Placed
CR52	Not Placed	Placed
CR53	Not Placed	Placed
CR54	Not Placed	Placed
CR90	Not Placed	Placed
Q51	Not Placed	Placed
Q52	Not Placed	Placed
R3	Not Placed	Placed
R4	Not Placed	Placed
R6	Not Placed	Placed
R7	Not Placed	Placed
R8	Not Placed	Placed
R25	Not Placed	Placed
VR5	Not Placed	Placed
VR0011	Not Placed	Placed

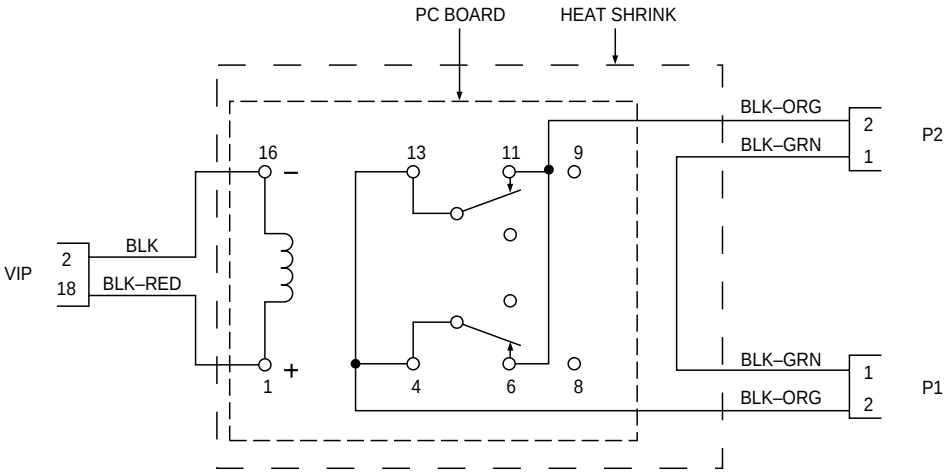
W9 Rear Control Head

There are no electrical differences between the front W9 and rear W9 control heads. Use the Spectra Detailed Service Manual, 68P80102W61, for part placement, parts list, and theory of operation.

HLN5574_ Relay Pod
HLN5575_ Relay Pod for DEK
Parts List

REFERENCE SYMBOL	MOTOROLA PART NUMBER	DESCRIPTION
	1510183A17	HOUSING, Two-Contact Connector
	1510183A18	HOUSING, Two-Contact Connector
	1580221J01	HOUSING, VIP Connector (HLN5574_)
	1580212L01	HOUSING, VIP Connector (HLN5575_)
	3910184A44	CONTACT, Receptacle
	3910184A45	CONTACT, Plug
	3984257L01	CONTACT, Plug
	8080075G03	RELAY





Notes

REPLACEMENT PARTS ORDERING

ORDERING INFORMATION

When ordering replacement parts or equipment information, the complete identification number should be included. This applies to all components, kits, and chassis. If the component part number is not known, the order should include the number of the chassis or kit of which it is a part, and sufficient description of the desired component to identify it.

Crystal orders should specify the crystal type number, crystal and carrier frequency, and the model number in which the part is used.

MAIL ORDERS

Send written orders to the following addresses:

Replacement Parts/
Test Equipment/Manuals/
Crystal Service Items:

Motorola Inc.
United States and Canada
Accessories and Aftermarket
Division
Attention: Order Processing
1313 E. Algonquin Road
Schaumburg, IL 60196

Federal Government Orders:

Motorola Inc.
United States and Canada
Accessories and Aftermarket
Division
Attention: Order Processing
7230 Parkway Drive
Landover, MD 21076

International Orders:

Motorola Inc.
United States and Canada
Accessories and Aftermarket
Division
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1313 E. Algonquin Road
Schaumburg, IL 60196

TELEPHONE ORDERS

United States and Canada Accessories and Aftermarket Division:
Call: 1-800-422-4210
1-800-826-1913 (For Federal Government Orders)
1-847-538-8023 (International Orders)

Servicers Training (VHS Video Tapes):
Call: 847-576-2828

FAX ORDERS

United States and Canada Accessories and Aftermarket Division:
FAX: 847-538-8198 (Domestic)
847-576-3023 (International)
Parts ID: 847-538-8194

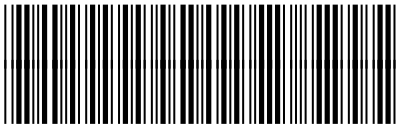
Federal Government Orders:
FAX: 410-712-4991
International: 410-712-6200

PARTS CUSTOMER SERVICE

United States and Canada Accessories and Aftermarket Division:
Call: 1-800-422-4210
Parts Identification:
Call: 847-538-0021

PRODUCT CUSTOMER SERVICE

Customer Response Center
(Sales and Service Assistance):
Call: 1-800-247-2346
FAX: 1-800-232-9272



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